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22 JUN 1967

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SUBJECT: Letter Report, Military Potential Test of Elapsed-Time  
Indicator, USATECOM Project No. 4-5-0101-08 ✓

TO: Commanding General  
U. S. Army Materiel Command  
ATTN: AMCPM-IR

1. Results of the subject test are contained in the inclosed report.
2. Test of the item on two different aircraft components revealed that one deficiency and one shortcoming exist. These are:
  - a. Deficiency - the item is susceptible to false readings caused by impact, i.e., rough handling, bumping jarring, or dropping.
  - b. Shortcoming - the indicator dial was difficult to read except when it was mounted in a vertical position.
3. It is concluded that:
  - a. When the deficiency has been corrected, the item will have military potential as a tool to provide information on the cumulative operation time of certain components returned from the field that are unaccompanied by normal maintenance forms and records.
  - b. Correction of the shortcoming would enhance the potential of the item.
4. It is recommended that the deficiency be corrected and the shortcoming be corrected as technically and economically possible prior to further Army consideration.

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*Incl 4*

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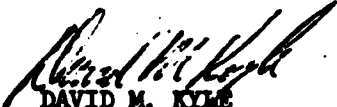
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Indicator, USATECOM Project No. 4-5-0101-08

5. Distribution of the report has been directed.

FOR THE COMMANDER:

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Ltr Rpt (5 cys)

  
DAVID M. KYLE  
Colonel, GS  
Dir, Avn Mat Testing

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DEPARTMENT OF THE ARMY  
UNITED STATES ARMY AVIATION TEST BOARD  
Fort Rucker, Alabama 36360

⑫ 14p.

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⑬ JUN 13 1967

SUBJECT: ~~Letter Report~~ Military Potential Test of Elapsed-Time  
Indicator, P/N 85986X, RDT&E Project No. \_\_\_\_\_  
USATECOM Project No. 4-5-0101-08

TO: See Distribution

⑭ USATECOM-4-5-0101-08

1. References.

a. Department of the Army Technical Manual 38-750, "Army Equipment Record Procedures," January 1964.

b. Letter, AMCPM-IRFO-T, Iroquois Field Office, US Army Materiel Command, 2 May 1966, subject: "Chandler-Evans Automatic Elapsed Time Meter," with 1st Ind, SMOSM-EGPT, US Army Aviation Materiel Command, 18 May 1966.

c. Letter, SMOSM-EGPT, Headquarters, US Army Aviation Materiel Command, 28 June 1966, subject: "Request for Testing of T53-L-11 PIP Engine, S/N LE-06005X, at the US Army Aviation Test Board, Fort Rucker, Alabama," with 1st Ind, Headquarters, AMSTE-BG, US Army Test and Evaluation Command, USATECOM Project No. 4-5-0101-07, 11 October 1966.

d. Pamphlet, Colt Industries, Inc., Chandler-Evans Control Systems Division, "Elapsed-Time Indicator," 1 August 1966.

e. Iroquois Test Coordination Meeting, US Army Aviation Test Board, 30 August 1966.

f. Letter, AMSAV-EAA, Headquarters, US Army Aviation Materiel Command, 26 September 1966, subject: "Military Potential

**FOR INFORMATION ONLY**

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Test of the Elapsed-Time Indicator, P/N 85986X, " with 1st Ind, AMSTEBG, Headquarters, US Army Test and Evaluation Command, 11 October 1966.

g. Letter, Bell Helicopter Company, 3 November 1966, subject: "Installation Sketches of Elapsed Hour Meter in the UH-1 Transmission Oil System."

h. Plan of Test, USATECOM Project No. 4-5-0101-08, "Military Potential Test, Elapsed-Time Indicator, P/N 85986X, " US Army Aviation Test Board, 4 January 1967.

i. "Minutes of the Iroquois Test Coordination Meeting, " US Army Aviation Test Board, 15 March 1967, with 1st Ind, AMCPM-IRFO-T, US Army Materiel Command, 7 April 1967.

## 2. Background.

a. The US Army Aviation Materiel Command (USAAVCOM) has indicated that a requirement exists for a device for permanently recording cumulative operating time on high-value components of Army aircraft. The US Army Test and Evaluation Command (USATECOM) at the request of USAAVCOM directed the US Army Aviation Test Board (USAAVNTBD) (reference c) to test the elapsed-time indicator to determine whether it meets this requirement.

b. The Directorate of Research, Development and Engineering, USAAVCOM, has a contract with the manufacturer for twelve of the test items. Two of the test items were delivered to Bell Helicopter Company (BHC) under the product-improvement programs. The test item is being evaluated by BHC as a means for maintaining operating time on the UH-1 ( ) helicopter transmissions. Two test items were delivered to Lycoming for utilization on T53 engine fuel controls under Lycoming's Extended-Life Service Program. Two test items were furnished the USAAVNTBD for this military potential test (reference f). The device is to be used as a tool to provide supplemental information on cumulative operating time

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on components returned from the field for supply stock, repair, or overhaul that are unaccompanied by normal maintenance forms and records. The test item is not intended to replace or supplement the requirements of Technical Manual 38-750, the Army Equipment Record Procedures, or related publications.

c. The item will be installed at manufacturer or depot overhaul and is not to be removed at organizational or direct- or general-support maintenance.

3. Description of Materiel. \* The test item (inclosure 1) is a fully encapsulated unit consisting basically of an electrolytic mercury cell, an accutron-quality mercury battery, and a pressure switch. The unit weighs 1.687 ounces. Installed, it is 0.9375-inch high, not including the 3/8 - 24 UNF threads on the rear for attachment. It has a 1.125-inch diameter indicator with a vertical reading scale graduated in 100-hour increments, accurate within three percent, from 0 to 1,500 hours, readable in the installed position at any orientation from 18 inches' distance. The test item is actuated by a pressure switch which senses an actuating pressure of  $40 \pm 5$  pounds per square inch. Temperature limits of the test item are from plus 250°F. to minus 15°F. The unit has a four-year shelf/service life from date of assembly and is surveillance marked with assembly date. Other features are a fail-safe provision incorporating a pressure-tight metal backing for the all-metal diaphragm and a backup seal between the case and the face of the indicator. The unit will operate under a force up to 130 G's; however, impact from dropping or other mishandling can cause a false reading.

#### 4. Test Objectives.

a. Purpose. To determine the military potential of the test item as a tool for measuring operating time of dynamic and other high-value components of aircraft.

\*Manufacturer's description.

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b. Objectives. To determine:

- (1) Physical characteristics.
- (2) Accuracy.
- (3) Durability.

5. Method. The USAAVNTBD conducted the military potential test of the elapsed-time indicator at Fort Rucker, Alabama, during the period 22 December 1966 through 21 April 1967. The two test items were initially installed on the fuel control and main-rotor transmission (reference f) in UH-1B, Serial No. 63-8659. Because of foreign object damage to Product-Improvement Engine T53-L-11, Serial No. LE-06005X, the test items were subsequently installed on the fuel control and main-rotor transmission in UH-1D, Serial No. 66-1094.

a. Physical Characteristics. The elapsed-time indicator was weighed, measured, and photographed, and significant physical characteristics were recorded.

b. Accuracy. The two test items were installed on the fuel control and the main-rotor transmission in the test-bed helicopters. The accumulative operating hours on the fuel control and the main-rotor transmission were recorded by project personnel and were compared with the indicator readings to determine the accuracy of the test item.

c. Durability. The test item was exposed to the normal maintenance environment, vibration levels, temperate climatic conditions, and stress loads encountered by the helicopter during the test period. Durability of the test item relative to expected service life, and reliability and readability of the test item relative to time in service (installed time) were determined.

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6. Summary of Results.

a. Physical Characteristics. The weights and dimensions of the elapsed-time indicator were:

|          |          |
|----------|----------|
| Weight   | 1.7 oz.  |
| Height   | 1.4 in.* |
| Diameter | 1.4 in.* |

b. Accuracy.

(1) The operating time on the fuel control and main-rotor transmission and the test item recorded time are shown in Tables I and II.

(2) The smallest reliable time increment that could be easily interpolated on the test item was 25 hours. For the purpose of this test, the test item time in the following tables was read with a magnifying glass.

TABLE I

FUEL CONTROL

| <u>Date</u> | <u>Fuel Control<br/>Operating Time<br/>(Hr.)</u> | <u>Elapsed-Time Indicator<br/>Recorded Time<br/>(Hr.)</u> | <u>Accuracy<br/>(% <math>\pm</math> 3)</u> |
|-------------|--|---|--|
| 27 Dec 66   | 0  | 0   | -  |
| 24 Jan 67   | 130.8  | 130.0 (Approx.)   | 100  |
| 22 Feb 67   | 316.1  | 310.0 (Approx.)   | 100  |

\*Outside case dimensions of the test item.

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| <u>Date</u> | <u>Fuel Control<br/>Operating Time<br/>(Hr.)</u> | <u>Elapsed-Time Indicator<br/>Recorded Time<br/>(Hr.)</u> | <u>Accuracy<br/>(% <math>\pm</math> 3)</u> |
|-------------|--|---|--|
| 26 Mar 67   | 575.4  | 700.0*  | -  |
| 27 Mar 67   | 0  | 700.0   | -  |
| 8 Apr 67    | 100.3  | 800.0 (Approx.)   | 100  |
| 21 Apr 67   | 190.0  | 890.0 (Approx.)   | 100  |

\*The mercury indicator moved to the 700-hour increment during removal and reinstallation of the fuel control. (See paragraph 6c(2).)

TABLE II

MAIN-ROTOR TRANSMISSION

| <u>Date</u> | <u>Main-Rotor Transmission<br/>Operating Time<br/>(Hr.)</u> | <u>Elapsed-Time Indicator<br/>Recorded Time<br/>(Hr.)</u> | <u>Accuracy<br/>(% <math>\pm</math> 3)</u> |
|-------------|---|---|--|
| 21 Dec 66   | 0   | 0   | -  |
| 24 Jan 67   | 144.8   | 150.0   | 100  |
| 22 Feb 67   | 330.1   | 330.0 (Approx.)   | 100  |
| 26 Mar 67   | 589.4   | 600.0   | 100  |
| 11 Apr 67   | 697.4   | 700.0   | 100  |
| 21 Apr 67   | 787.1   | 790.0 (Approx.)   | 100  |

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c. Durability.

(1) The test item installed on the transmission was removed and reinstalled one time during the test period and continued to function satisfactorily.

(2) The test item installed on the fuel control was removed and reinstalled three times during the test period and continued to function satisfactorily; however, during removal of the fuel control from T53-L-13 engine, Serial No. LE-10007, and reinstallation on engine, Serial No. LE-14067, the fuel control was jarred causing the mercury to move to the 700-hour graduation mark on the test item. (See Table I.)

(3) Test results indicated that the expected service life of the indicator will parallel that of the fuel control and main-rotor transmission and that reliability was satisfactory, except when the test item was subjected to rough handling. (See paragraph 6c(2).)

(4) Operating time (765 and 790 hours) on the indicators had no effect on readability. When the indicator was not mounted in the vertical position, the indicator dial was difficult to read. This difficulty was attributed to the small size of the test indicator (1.4-inch outside diameter).

d. Deficiencies and Shortcomings. One deficiency and one shortcoming were discovered and are listed in inclosure 2.

7. Conclusions.

a. When the deficiency listed in inclosure 2 has been corrected, the elapsed-time indicator will have military potential as a tool that records cumulative operating time on fuel controls and main-rotor transmissions of Army aircraft.

b. Correction of the shortcoming listed in inclosure 2 would enhance the potential of the elapsed-time indicator.

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8. Recommendation. It is recommended that the deficiency be corrected and the shortcoming be corrected as technically and economically feasible prior to further Army consideration.



RAYMOND E. JOHNSON  
Colonel, Artillery  
President

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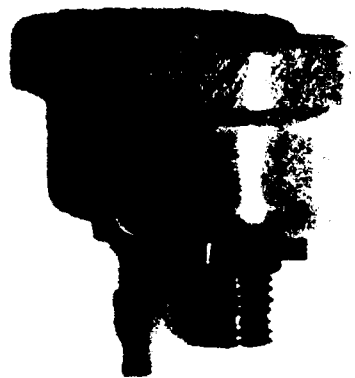
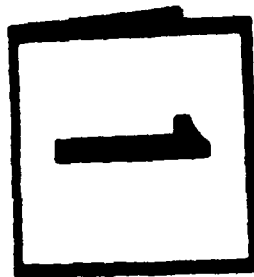
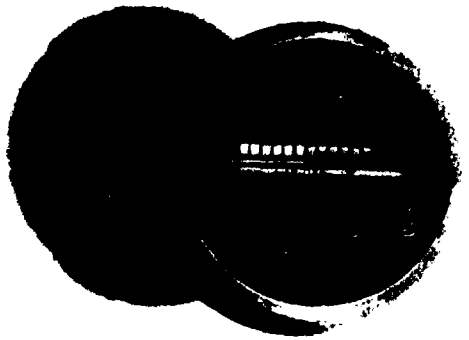
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# ELAPSED TIME INDICATOR

USATECOM

PROJECT NO. 4-5-0101-08

DEFICIENCIES AND SHORTCOMINGS

| <u>Deficiency</u>  | <u>Suggested<br/>Corrective Action</u> | <u>Remarks</u> |
|--|--|----------------|
| The indications on the indicator are susceptible to false readings caused by impact, i. e., rough handling, bumping, jarring, or dropping. | None.                                  | None.          |

| <u>Shortcoming</u>   | <u>Suggested<br/>Corrective Action</u> | <u>Remarks</u> |
|--|--|----------------|
| The indicator dial was difficult to read except when the indicator was mounted in a vertical position. | None.                                  | None.          |

INCLOSURE 2